Is There a Difference between Regionally-Estimated BRFSS Health Indicators and those Calculated through Community Health Assessments led by County Health Departments?

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ABSTRACT

Community Health Assessments (CHAs) have been emphasized in recent years due to changes in accreditation and funding standards after the 2011 passing of the Affordable Care Act. Local health departments (LHDs) often adapt methodologies from The Behavioral Risk Factor Surveillance System (BRFSS) in their primary data collection. As BRFSS moves to provide more locality-specific estimates and low-resource LHDs are required to collect primary data, it is necessary to determine whether BRFSS regional estimates could be a sound substitute for CHA-collected data. This study aims to determine if a difference exists between health indicators that are calculated through Ohio BRFSS regional-estimates and those calculated through CHAs led by 3 county health departments. Using two-sample z-tests, percent prevalence of chronic illness, as reported in each county's CHA, was compared to its respective BRFSS regional estimate. 6 (27.3%) of the indicators were found to be statistically significantly different. Each county had 2 indicators that were statistically different from the regional estimate; no specific chronic illness was found to statistically significant in more than one county/regional comparison. Although the majority of indicators were statistically insignificant, further research must be done in order to fully understand the potential overlap between BRFSS regional estimates in CHA data. More transparency and collaboration in locality-specific data is needed, especially in low-resource, rural settings.

INTRODUCTION

The purpose of this study is to determine whether a difference exists between Behavioral Risk Factor Surveillance System (BRFSS) region-level health indicators that are calculated by state BRFSS coordinators and those calculated through community health assessments (CHAs) administered by local health departments (LHDs). The comparisons focused specifically on the percent prevalence of chronic illnesses such as asthma, diabetes, high cholesterol, and high blood pressure in central and southeastern Ohio.

This study aims to provide insight into a larger research question: is it necessary for LHDs, especially those with minimal resources, to collect primary data when data for the same indicators can be estimated for the particular county or small area using a national or state dataset? Through a review of current policy and practice and previous literature, in combination with secondary analysis of BRFSS and LHDs collected data, this study attempts to understand whether or not BRFSS regional estimates be a sound substitute for the data LHDs collected through CHAs.

BACKGROUND & LITERATURE REVIEW

Community Health Assessments (CHAs)

CHAs are a vital tool for identifying and quantifying health concerns in communities across the United States. The U.S. Centers for Disease Control and Prevention (CDC) defines a CHA as a "state, tribal, local, or territorial health assessment that identifies key health needs and issues through systematic, comprehensive data collection and analysis." CHAs can be grouped together with Community Health Needs Assessments, or CHNAs. The process and goals behind CHAs and CHNAs are similar: to identify local health concerns and community

resources that can be used to mitigate those concerns. However, CHNAs tend to be completed by hospitals or healthcare groups, while local health departments (LHDs) tend to conduct CHAs.[1] Both CHAs and CHNAs inform Community Health Improvement Plans (CHIPs), comprehensive long-term, policy and intervention-driven efforts to address local health concerns.[2] For the purpose of this study, the history, methods, and effectiveness of assessments led specifically by LHDs will be discussed in greater detail.

In 1988, through their report entitled, *The Future of Public Health*, the Institute of Medicine (IOM) identified assessment as one of the core functions of public health and deemed LHDs responsible for assessing the health needs of their communities.[3] Since the IOM report, LHDs have conducted CHAs while relying on assistance from state and federal government agencies in data collection and analysis when needed.[3] There is no overarching set of requirements for CHAs; LHDs are able to set their own methodology. Although methods differ, there is a general set of health outcomes and determinants that LHDs strive to identify through CHAs. In 1991, the CDC published a comprehensive set of health outcomes and determinants, such as leading causes of death, cancer rates, health insurance coverage, and health behaviors, with the intention of CHA data to be better understood both within and between localities.[3] Countless CHA models, frameworks, and procedural guidelines have been published over the past few decades to help LHDs plan their methodology and analysis. These models and frameworks, published by organizations such as the CDC and National Association of County & City Health Officials (NACCHO), have informed the procedures for countless CHAs and encourage partnerships with hospitals, universities, and other organizations invested in the health of their community.

CHAs incorporate both primary data collection and secondary data analysis. Primary data collection is usually in the form of a survey; sometimes interviews are conducted.[2] For secondary data analysis, LHDs analyze health indicators that have been collected by another agency or organization. Most try to use data that has already been benchmarked to apply to their particular community.[2] The CDC recommends that LHDs consult national datasets such as the County Health Rankings, the Dartmouth Atlas of Healthcare, the National Health Indicators Warehouse and the Behavioral Risk Factor Surveillance System (BRFSS) for benchmarked health indicators that can be used to better asses the health status of their particular locality.[2] As seen in the three CHAs analyzed in this study, BRFSS also informs primary data collection, as LHDs use BRFSS-designed questions in their community health surveys. The use of BRFSS within, and potentially in place of, CHAs is the main focus of this research project.

In the past several years, public health practitioners have increasingly focused on CHAs due to changes in accreditation standards and the 2010 passing of the Patient Protection and Affordable Care Act (PPACA). In order to be accredited through National Voluntary Public Health Accreditation by the Public Health Accreditation Board,[3] LHDs must complete a CHA.[4] Moreover, the PPACA funds Community Transformation Grants to reduce chronic illness; CHAs are a requirement in order to receive these grants.[3] Additionally, the PPACA mandated that non-profit hospitals must complete a CHNA every three years or they will lose their status as a tax-exempt organization. The law specifically states that "a CHNA must, at a minimum, take into account input from (1) persons with special knowledge of or expertise in public health; (2) federal, tribal, regional, state, or local health or other departments or agencies, with current data or other information relevant to the health needs of the community served by the hospital

facility[5]". Thus, there is increased motivation and interest among community stakeholders in assessing the health of their communities. With increased motivation and interest comes increased time and money spent on assessing community health concerns.

This study analyzes three CHAs that were conducted in central and southeastern Ohio. CHAs are particularly relevant in Ohio, as the Ohio Revised Code requires LHDs to be accredited by PHAB by 2020 in order to receive funding from the Ohio Department of Health.[1] As previously noted, as of 2011, CHAs are a necessary component for voluntary accreditation with PHAB. In regard to these changes in accreditation and funding standards, the non-partisan think tank, Health Policy Institute of Ohio, issued a policy brief on community health planning in the state. CHAs, which were found to be more common than CHIPs, are comprehensive and helpful in reporting health behaviors and other community-centered data.[1] However, there is significant room for improvement especially with regard to state and local level collaboration and data transparency.[1] LHDs are not required to submit their CHAs to the state database of community health data.[1] Therefore, there is no central portal where community health data can be accessed. This likely hinders collaboration among LHDs in Ohio and prevents a full understanding of what local-level health data already exists.

Given the increased emphasis on community health and the changing landscape surrounding CHAs, the effectiveness of CHAs should be well understood. However, few studies have attempted to quantify how effective these assessments are. Rabarison et.al studied LHDs and CHAs across the U.S. and found that LHDs who conducted a CHA and devised a CHIP were two times more likely to implement chronic disease prevention programs in their communities than LHDs who did not complete a CHA and a CHIP.[6] Thus, the CHAs and CHIPs likely led to

more-informed decision making among LHD officials. This has potential to be problematic, especially in Ohio, as not every LHD who completes a CHA also completes a CHIP. The HPIO Policy Brief found that 88.7% of LHDs in Ohio had completed a CHA in the past 5 years while only 52.4% had completed a CHIP.[1] As LHDs in Ohio and other states continue to conduct CHAs for the purpose of accreditation and funding, it is imperative that the effectiveness of these assessments and all community health planning tools are better understood.

The Behavioral Risk Factor Surveillance System (BRFSS)

BRFSS is commonly referenced in CHAs. It is often referred to as the "gold standard" for self-report data.[7] First conducted by the CDC in 1984, it is the largest health survey in the world, with over 500,000 telephone surveys conducted each year.[7] It has evolved into a collaborative project, with administrative oversight by the CDC and data collection, which takes place on a state-specific basis, by all fifty states and several territories. The purpose of the survey is to "collect uniform, state-specific data on preventive health practices and risk behaviors that are linked to chronic diseases, injuries, and preventable infectious diseases that affect the adult population[8]".

BRFSS data is gathered on a yearly basis. State health departments employ BRFSS coordinators to lead their specific state's data collection. Some collect the data themselves, while others use contractors.[8] Telephone numbers for surveying are selected through random-digit-dialing (RDD); to account for the recent rise in cell phone use and decline in landline ownership, BRFSS adapted in 2011 to include cell phone numbers in RDD.[7] However, the sample is not random. BRFSS uses a disproportionate stratified sample (DSS) for landline surveying.[8] Landline numbers are separated into two strata based upon their geographic proximity to other

landline numbers. These stratum are then surveyed separately, allowing BRFSS to survey a probability sample of all households with telephones.[8] For cellphone surveying, BRFSS uses the Telecordia cellphone number database to create intervals of numbers based upon the number of phone numbers within 1,000 digit sets and the desired sample size of the survey. Numbers are then randomly selected from the created intervals.[8] Each state begins the surveying process as a single stratum; however, most states, including Ohio, sample disproportionately among strata that represent certain geographic regions within the state.[8]

Whether the BRFSS interview is being conducted by a state coordinator or outside contractor, there is a standard BRFSS protocol that determines how the data is collected. For example, the official BRFSS questionnaire must be used and the survey must be conducted using Computer Assisted Telephone Interviewing (CATI) software.[8] Every January, an official BRFSS core questionnaire and optional modules are released. This questionnaire has been compiled by state coordinators and CDC-employed BRFSS officials and must be administered to respondents without any changes.[8] States have the option to include additional BRFSS-designed modules that target specific health concerns after the core questions are asked and to add their own questions at the end of the survey.[8] Thus, the final survey can look quite different from state to state. Response rates vary from state to state and year to year. For 2013, the BRFSS data year in question, the response rate in Ohio was 48.2%.[9]

BRFSS data is gathered continuously throughout the year on different days of the week and during varied times of day. It is sent to the CDC on a monthly basis for cleaning, weighting, and analysis. Final data analysis takes place at the end of each calendar year.[8] The data undergoes complex weighting in order to ensure that it is representative of each state's

population. First, data is weighted in order to account for unequal probability of selection into the survey.[8] In 2011, BRFSS began weighting its data using iterative proportional fitting, also known as raking.[8] Data is weighted according to age, gender, race and ethnicity, geographic location, educational attainment, marital status, telephone source, home-ownership status, and various combinations of the aforementioned demographic characteristics.[8] County-level population estimates used in weighting for age, race and ethnicity, and gender were purchased from The Nielsen Company, LLC.[10] American Community Survey(ACS) estimates for educational attainment, marital status, and homeownership were also used in weighting.[10]

After the CDC completes it analysis, a summary report and a compilation of each state and participating territory's weighted data is released back to the health department and they are then able to use the data as they so choose.[8] Many state coordinators compile additional reports that focus on demographic and geographic variations in heath behaviors and chronic illnesses within their state, as Ohio did in the 2013 BRFSS Annual Report, which is analyzed in this study.

BRFSS has long been considered one of the most reliable and valid forms of self-reported health data. Its data is used in countless other studies and its procedures are modeled among countless other surveys, including CHAs run by LHDs. Studies have analyzes the reliability and validity of specific measures within BRFSS, but few have attempted to analyze the overall reliability and validity of the survey. Prior to the incorporation of cellphone surveying, Periannunzi et.al conducted a systematic review of all studies assessing the reliability and validity of BRFSS measures and found it to be as reliable and valid as self-report data can be.[11] The reliability and validity of BRFSS was high in comparison to other self-report surveyed but

when compared to data that incorporated physical measures of health, it was found to be less reliable and valid.[11] However, the overall reliability and validity of self-reported data is outside of the scope of this particular study. Since the incorporation of cellphones into the BRFSS methodology, no studies have analyzed its reliability or validity. As previously stated, it is generally assumed among public health practitioners that BRFSS is the "gold standard" of self-reported data and is used accordingly.

Although weighted by geographic region, BRFSS datasets traditionally have not been allowed for analysis by smaller geographic regions within a particular state in order to protect the privacy of the respondents. In recent years, however, BRFSS has been working to localize their data and provide comprehensive health information at the local level. This has been especially noticeable through the SMART, or Selected Metropolitan/Micropolitan Area Risk Trends program. Since the early 2000s, BRFSS officials at the CDC have released local-area estimates of health behaviors and chronic illnesses according to the metropolitan or micropolitan statistical areas (MMSAs) as designated by the U.S. Census Bureau.[12] However, regionally estimated data for small areas or counties that do not fall into census-designated MMAS areas, such as those analyzed in this study, are not reported by the CDC. Thus, they are difficult to locate.

Through SMART, urban, high-populated areas have access to additional locality-specific BRFSS data while rural, less-populated areas do not. State BRFSS coordinators work with their respective BRFSS datasets to further analyze it by region that so that all localities have accessible small-area health estimates. However, this data is rarely publicly available. After an

extensive Internet search, the 2013 Ohio BRFSS Annual report was the only data source found for the state that separated BRFSS variables according to intrastate regions.

Comparing Locally-Collected Data to BRFSS

Little exists in the literature with regard to the comparison of BRFSS regionally-estimated data to data collected by local health departments using BRFSS core questions or modules. Jackson et.al (1992) compared BRFSS estimates of cardiovascular risk behaviors and prevalence of cardiovascular diseases including hypertension, high cholesterol, and obesity in Northern California to self-report estimates and physical health measures gathered through the Stanford Five-City Survey.[13] Estimates between the two surveys were found to be similar for prevalence of hypertension, smoking status, number of cigarettes smoked per day, and cholesterol level.[13] There were significant differences between the two surveys' estimations of controlled hypertension, obesity, and BMI level.[13] Through the self-report survey, respondents were likely to overestimate the degree to which their high blood pressure was controlled and underestimate their weight.[13]

Although dated, the Jackson et.al study provides significant insights into the comparison of BRFSS data to locally collected data on health behaviors and chronic illnesses. Two of the health indicators assessed in this study, hypertension and high cholesterol, were found to be similar between the two surveys analyzed in the Jackson et.al study. Aside from the Stanford Five City Survey study, the literature reflects little, if any, research that is closely related to the research question of this particular study. Given the recent emphasis on CHAs, the continual use of BRFSS in CHA procedures, and the rise in small-area estimation among BRFSS

coordinators, it is necessary to better understand the intersection and potential overlap between these two sources of local health data.

METHODS

Study Design

This study is a secondary data analysis of health indicators gathered through BRFSS and from CHAs led by three county health departments in Central and Southeastern Ohio: Hocking, Licking, and Perry, and regional estimated indicators from Ohio BRFSS. County-level prevalence rates of chronic illnesses were compared to prevalence rates for each county's respective BRFSS-designated region within the state, as identified in the Ohio Department of Health's 2013 BRFSS Annual Report. While these counties are geographically close to one another, they fall within three different BRFSS-designated regions in Ohio. Each of these counties' health departments completed a CHA in the four years prior to this study; surveys that used BRFSS-designed questions were a primary component of each of those assessments. These counties were selected for analysis primarily due to their connection with The Ohio State University's Center for Public Health Practice, the availability and accessibility of data, and the use of BRFSS-designed questions in their primary data collection. These counties are likely not representative of their respective BRFSS-designated regions.

Variables of Interest

Self-reported prevalence of several chronic illnesses, including asthma, diabetes, high cholesterol, high blood pressure, and skin cancer, were the health indicators used for comparison. These specific variables were chosen since they were the only regionally identified

variables in the Ohio 2013 BRFSS annual report. Additionally, the CHA surveys for all three counties asked respondents if they had ever been diagnosed with chronic illnesses using essentially identical questioning as listed in the BRFSS module, allowing for more sound comparison of the data.

Procedures

Once the results from each county's most recent CHA were obtained, the methodology behind the surveys conducted in each county was analyzed in order to identify potential methodological differences between each county's specific survey methodology and that of BRFSS. Each county's CHA survey methodology is described in the following sections, followed by a description of the methodology of 2013 BRFSS Annual Report.

Hocking County (Ohio BRFSS Region 10)

Hocking County Health Department conducted a Community Health Assessment in the fall of 2015, with partnership with The Ohio State University Center for Public Health Practice and the private research firm, Illuminology, LLC. For the primary data analysis portion of their CHA, Hocking County mailed the information about the CHA and the link to complete its online survey to a random sample of addresses within the county. Paper copies of the survey were then mailed to those who did not initially complete the survey via the Internet. The survey yielded 326 responses and margin of error was reported to be $\pm$5.4% for a 95% confidence interval and a response rate of 24%.[14] Prior to analysis of the data, a base weight was applied in order to account for unequal likelihood of selection. That weight was then further adjusted according to the respondent's particular demographics (age, gender, education status, and

income level) so that the data aligned with the most recent population benchmarks for Hocking County as reported in the 2013 American Community Survey.[14]

Those who responded to Hocking County's survey were asked about prevalence of chronic illness, according to the BRFSS module: "Has a doctor, nurse, or other health professional EVER told you that you had…[14]". The question then listed asthma, skin cancer, other types of cancer, diabetes, high blood pressure, and high blood cholesterol, with an option for the respondent to choose "yes" or "no," indicating whether or not they had been diagnosed with the disease. A copy of Hocking County's Health Survey is included in the Appendix.

Licking County (Ohio BRFSS Region 7)

Licking County Health Department conducted a Community Health Assessment in 2015, with partnership from Wright State University's Center for Urban and Public Affairs. For the primary data collection of their CHA, Licking County conducted a survey of a simple random sample all listed telephone numbers in the county. There were a total of 558 responses with a sampling error of ±4.13% for a 95% confidence interval.[15] No response rate was given. Prior to analysis, the data was weighted according to demographics (age, race, gender) in order to align with the 2014 American Community Survey population estimates for Licking County.

Those who completed the phone interview were asked: "Have you EVER been told by a doctor, nurse, or other healthcare professional that you had…[15]". The interviewer then listed several chronic illnesses including high cholesterol, high blood pressure, asthma, and diabetes. Respondents had a moment to respond "yes," "no," or "don't know" between each illness. Sections four, five, and six of the interviewer's script, which includes the questions regarding prevalence of chronic illnesses, are included in the Appendix of this report.

Perry County (Ohio BRFSS Region 8)

Perry County conducted a CHA in early 2012 in collaboration with Wright State University's Center for Urban and Public Affairs, The Ohio State University's Center for Public Health Practice and the private research firm, The Strategy Team, Ltd. For the primary data collection portion of their CHA, Perry County used random digit dialing to conduct the simple survey over the phone. BRFSS questions and procedural processes were used in their entirety. The survey yielded 502 responses with a sampling error of ±4.3% for a 95% confidence interval.[16] Prior to analysis, five weights were applied to the data, based upon the demographic characteristics of the respondent so that the overall data set aligned with the most recent demographic measures of Perry County according to the 2010 American Community Survey.[16]

Those who completed the phone survey were asked about the variables in question, prevalence of chronic illnesses, according to the BRFSS survey procedures: "Has a doctor, nurse, or health professional EVER told you that you had any of the following…[16]". The interviewer then stated multiple chronic illnesses, including high blood pressure, high cholesterol, asthma, skin cancer, arthritis, and depression. The respondent had a moment between each illness to state "yes," "no," or "not sure." Sections four, five, and six of the survey questionnaire, which address the variables in question, are included in the Appendix of this report.

2013 Ohio BRFSS Annual Report

In 2014, the Ohio Department of Health BRFSS coordinators compiled a report on health behaviors and chronic illness in Ohio using BRFSS data that was collected throughout 2013. This report was compiled after analyzing data, which was acquired using the standard BRFSS

methodology, as described in the literature review, and questionnaire module for that year. According the 2013 BRFSS Questionnaire, questions that address the variables analyzed in this study were asked as follows:

- Have you EVER been told by a doctor, nurse, or other healthcare professional that your blood cholesterol is high?
- Have you EVER been told by a doctor, nurse, or other healthcare professional that you have high blood pressure?
- Has a doctor, nurse, or other health professional EVER told you that you have any of the following?
    - (Ever told) you have asthma?
    - (Ever told) you had skin cancer?
    - (Ever told) you had any other types of cancer?
    - (Ever told) you have some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia?
    - (Ever told) you have a depressive disorder including depression, major, depression, dysthymia, or minor depression?
    - (Ever told) you had diabetes?

After each question, respondents had the opportunity to answer "yes," "no," or "don't know[17]". In total, there were 11,972 BRFSS telephone interviews conducted via random-digit dialing in Ohio in 2013.[18] Small-area estimation was a focus of BRFSS that year. According to the report, "In 2013, BRFSS oversampled 10 regions and six individual counties in Ohio in order to produce regional estimates for key indicators." However, prevalence measures for chronic illnesses were the only variables that were reported according to region. No sample sizes for the specific regions were given in the report. Additionally, there is no explanation as to how the ten regions were identified.

The 2013 Ohio BRFSS Annual Report contains no overall margin of error for the report; individual margins of error were reported for each data indicator. For example, 95% confidence intervals for each regional measure of chronic illness prevalence were reported alongside the measure. In congruence with national BRFSS standards, prior to analysis, the data was weighted according to age, race, ethnicity, telephone ownership, marital status, educational attainment, home-ownership, and geographic region in order to align with the population proportions for Ohio.[18]

Data Analysis

The first step of data analysis was to plot the percent prevalence of each illness according to the county's CHA alongside the percent prevalence for that county's BRFSS region. Data was plotted on a clustered bar graph in Microsoft Excel using error bars that represented the 95% confidence interval for each estimate. The graphs were then analyzed in order to identify any chronic illnesses where the 95% confidence interval for the percent prevalence according to the CHA did not overlap with the 95% confidence interval according to the BRFSS Annual Report.

After visual analysis of confidence intervals, data was analyzed for statistically significant differences, by hand, using two sample z-tests. This method of comparing percentages obtained from different surveys was adapted from the American Community Survey User Guide.[19] The standard error of each percent prevalence measure was calculated by dividing the margin of error by 1.96, which is the critical value for a 95% confidence interval. All measures from a county CHA had the same standard error, as the margin of error for all measures reported in the CHAs were the same. However, the standard error for the regional measures

varied as the margin of error was independently reported for each prevalence measure in the Ohio BRFSS Annual report.

Once the standard errors for a particular data comparison were calculated, the two prevalence measures and associated standard errors for a particular county were then used to generate a z-score (see Figure 1). If the z-score was greater than the standard critical value of 1.96, the two prevalence measures were found to be statistically significant from one another. The formulas used for data analysis and a sample calculation, as used to determine statistical significance between two measures of asthma prevalence in Hocking County, can be seen in Figure 1. Complete calculations are included in the Appendix.

Figure 1: Sample Calculation for Comparing Two Indicators

Calculations for Percent Prevalence of Asthma
Hocking CHA vs. BRFSS Region 10

$$SE = \frac{MOE}{1.96}$$

$$SE_{Hocking} = \frac{5.4}{1.96} = 2.76 \quad SE_{Region\ 10} = \frac{3.35}{1.96} = 1.71$$

$$\left| \frac{X_1 - X_2}{\sqrt{SE_1^2 + SE_2^2}} \right| > Z_{95\%}$$

$$\left| \frac{14 - 11.8}{\sqrt{2.76^2 + 1.71^2}} \right| = 0.68;\ 0.68 < 1.96$$

These values are **not** statistically significant.

RESULTS

Figures 2 through 4, which are included in the Appendix, show the percent prevalence of each chronic illness for the CHAs and state-level BRFSS. Blue bars represent the percent prevalence gathered through the CHAs; red bars represent the percent prevalence as estimated for that county's BRFSS-designated region according to the 2013 Ohio BRFSS Annual Report. CHA-calculated prevalence measures that were found to be statistically significantly different (based on subsequent z-tests) from their respective BRFSS region measure are marked with an asterisk on the graph.

Upon examining the bar graphs, it was found that most percent prevalence measures had overlapping confidence intervals. For the data from Hocking County, confidence intervals overlapped for all illnesses except for skin cancer. However, the intervals for skin cancer prevalence were close to one another; the top bound of BRFSS interval was 7.3 and the bottom bound for CHA interval was 7.4. For the data from Licking County, confidence intervals overlapped for all illnesses except for arthritis. For the data from Perry County, confidence intervals did not overlap for both depression and high cholesterol. The distance between the intervals for high cholesterol were especially noticeable, with the high bound for the CHA measure at 39.3% and the low bound for the BRFSS Region 8 measure at 43.3%. It appeared that the majority of CHA prevalence measures were not different from their BRFSS region counterparts.

Results from the second portion of data analysis, z-tests to measure statistical significance, are indicated in Tables 1 through 3. Statistically significant measures are indicated with an asterisk alongside the calculated z-score. Both prevalence measures and the associated

confidence interval are included in the tables. Chronic illness prevalence measures from a specific county that were statistically significant from the BRFSS prevalence measures for its region are marked with an asterisk. For Hocking County, prevalence measures for high blood pressure and skin cancer were both found to be statistically significant. For Licking County, prevalence measures for both arthritis and asthma were found to be statistically significant. For Perry County, prevalence measures for depression and high cholesterol were both found to be statistically significant. As expected, confidence interval overlap was a good predictor of statistical insignificance; Hocking County's measures for high blood pressure and Licking county's measures for asthma were the only statistically significant measures that had overlapping intervals.

For a total of 22 prevalence measures, 6 (2 in each county) were found to be statistically significantly different for CHAs vs. state-level BRFSS (27.3% of the measures). The 6 measures represented 6 different chronic illnesses. CHA Diabetes and other cancer were not found to be statistically significantly different for any of the 3 counties studied.

Table 1: Hocking County CHA vs. BRFSS Region 10

Chronic Illness	***Hocking County CHA (95% Confidence Interval)***	***BRFSS Region 10 (95% Confidence Interval)***	***Z-Score***
Asthma	14.0 (8.6 – 19.4)	11.8 (8.4 – 15.1)	**0.68**
Diabetes	16.4 (11.0 – 21.8)	15.1 (11.9 – 18.4)	**0.40**
High Blood Pressure*	47.2 (41.8 – 52.6)	39.5 (35.0 – 44.1)	**2.14***
High Cholesterol	40.0 (34.6 – 45.4)	42.0 (37.0 – 47.0)	**0.14**
Other Cancer	11.0 (5.6 – 16.4)	7.6 (5.6 – 9.7)	**1.14**
Skin Cancer*	12.8 (7.4 – 18.2)	5.6 (3.9 – 7.3)	**2.49***

Table 2: Licking County CHA vs. BRFSS Region 7

Chronic Illness	*Licking County CHA (95% Confidence Interval)*	*BRFSS Region 7 (95% Confidence Interval)*	*Z-Score*
Arthritis*	35.0 (30.9 – 39.1)	26.8 (23.2 – 30.4)	**2.93***
Asthma*	15.1 (11.0 – 19.2)	9.2 (6.7 – 11.8)	**2.38***
Depression	22.0 (17.9 – 26.1)	19.3 (15.9 – 22.7)	**0.99**
Diabetes	13.4 (9.3 – 17.5)	10.0 (7.5 – 12.6)	**1.37**
High Blood Pressure	33.0 (28.9 – 37.1)	34.3 (30.3 – 38.3)	**0.44**
High Cholesterol	38.5 (34.4 – 42.6)	35.4 (31.0 – 39.8)	**1.01**
Other Cancer	5.9 (1.8 – 10.0)	7.0 (5.2 – 8.9)	**0.48**
Skin Cancer	9.4 (5.3 – 13.5)	6.3 (4.7 – 7.8)	**1.38**

Table 3: Perry County CHA vs. BRFSS Region 8

Chronic Illness	*Perry County CHA (95% Confidence Interval)*	*BRFSS Region 8 (95% Confidence Interval)*	*Z-Score*
Arthritis	35.0 (30.7 – 39.3)	32.4 (28.4 – 36.4)	**0.87**
Asthma	13.0 (8.7 – 17.3)	9.4 (6.8 – 12.1)	**1.40**
Depression*	16.0 (11.7 – 20.3)	24.7 (20.8 – 28.6)	**2.94***
Diabetes	12.0 (7.7 – 16.3)	11.6 (8.9 – 14.2)	**0.16**
High Blood Pressure	35.0 (30.7 – 39.3)	38.8 (34.5 – 43.1)	**1.23**
High Cholesterol*	34.0 (29.7 – 38.3)	48.3 (43.3 – 53.3)	**4.25***
Other Cancer	6.0 (1.7 – 10.3)	8.6 (6.3 – 10.9)	**1.17**
Skin Cancer	6.0 (1.7 -10.3)	7.0 (4.9 – 9.1)	**0.41**

DISCUSSION

This study is quite timely, as it analyzes CHAs, which have been increasingly emphasized by public health practitioners in recent years. As discussed in the background section of this report, there are several factors, including accreditation and funding standards, which motivate LHDs to complete CHAs. As LHDs attempt to understand the health issues in their particular communities, CHAs, in addition to secondary data sources and national datasets, especially

BRFSS, are essential resources. Simultaneously, BRFSS Coordinators have been using their data to better understand health behaviors and chronic illnesses in small areas within their state. BRFSS state coordinators, at least in Ohio, are reporting their data according to designated intrastate regions. Often, LHDs are using the same survey questions, thereby collecting more or less the same data that BRFSS already collects annually. This study aimed to determine if there is a difference between regionally estimated health indicators and those gathered through LHD-run CHAs.

The results of this study were somewhat inconclusive. While there was no statistically significant difference between the majority of the indicators analyzed, over one-quarter of the indicators were found to be statistically different between CHA and BRFSS regional data. From the literature review and analysis of the subjects, it was found that the subjects essentially completed their CHA surveys using the exact same methodology and questionnaire as BRFSS. The one main difference was that Hocking County chose to complete their survey on-line or by mail. This may have led to more accurate data through its CHA, as respondents may have been more comfortable sharing personal health information through these mediums rather than over the phone. However, high blood pressure and skin cancer, the two prevalence indicators found to be statistically different in Hocking County are not particularly stigmatized health issues. Nevertheless, survey delivery mode is a potential reason why differences were found in Hocking County, as the mode differed between the two data sources.

Weighting procedures were also quite similar; it appears that BRFSS data is weighted more complexly that CHA data. This is likely because BRFSS data must comply with national BRFSS standards; each state's dataset is weighted using the same raking methodology that was

described in the background section. BRFSS coordinators also have a great availability of assistance with any additional complex statistical weighting procedures that may apply to their particular state. Whereas, CHA coordinators from LHDs likely have limited resources in regard to statistical analysis. Some of the LHDs in this study added locality-specific questions, but all used the core component of the BRFSS module. Most notably, there was no difference in the wording of the questions regarding prevalence of chronic illnesses between the CHAs and BRFSS. According to the results of this study, LHDs may be completing CHAs only to obtain data of which the majority already exists. However, given that the study found six indicators that were statistically different, it is possible that CHAs may gather additional, essential data. Also, intrastate regionally estimated BRFSS data, especially in Ohio, was difficult to locate. Even if the regional data exists, if it is not shared readily between BRFSS state coordinators and local-level public health practitioners, it renders itself unusable.

This study poses several potential implications regarding public health decision-making and funding allocations at the local level. If LHDs do not use accurate data to inform their decision-making and program planning, they may direct their already limited funding toward areas that are not of the highest concern in their community. For example, if Perry County Health Officials relied only on their CHA data, they may not be directing enough attention toward high cholesterol education, management, and prevention in their community. That being said, relying solely on the BRFSS estimate may lead to a higher investment of time and energy into reducing high cholesterol and decreased attention on other health concerns in the community including high blood pressure and arthritis. Practical problems like these are sure to become commonplace unless there is more transparency and collaboration among public

health practitioners in locality-specific data. If anything, the potential implications show that there is a need for continued research into this topic.

Limitations

There are several limitations to this study. For example, the number of counties studied, in addition to the number of variables analyzed, was small. This was due to the lack of publicly available results from LHD-run CHAs in the Ohio BRFSS regions of study. Although six prevalence measures were found to be statistically significantly different, it is not clear if it is because of problems in the BRFSS regional estimation process or because this particular county is in outlier within the region in regard to that particular chronic illness. Moreover, BRFSS is a national dataset and this study only analyzed its use within the state of Ohio. Analysis of the use of BRFSS in other states, especially with regard to regional estimation, is outside the scope of this study.

Time is also a potential limitation factor in this study. Data was collected in 2012(Perry) and 2015(Hocking and Licking) for the CHAs and in 2013 for the Ohio BRFSS Annual Report. However, since the specific measure for comparison was data concerning chronic illnesses, it is likely that the percentages would not have been much different if they had all been collected in the same year. Chronic illness prevalence tends not to change much from year to year since those who have the diseases tend to have them for the remainder of the life course. This is especially true because the questions used asked: “Have you EVER been diagnosed with said illness/condition,” which does not place the diagnosis within a specific time frame.

Recommendations for Further Research

Further research must be done in order to better understand the differences between BRFSS data that is collected at the local level and BRFSS data that is collected at the state level and estimated to a specific geographical region. This topic is new to the literature, and should be studied in greater detail, as it addresses critical questions regarding the effectiveness and necessity of CHAs. Future studies should attempt to mitigate the limitations associated with this study. For example, CHA-collected data for each county in a particular BRFSS region should be compared to the regional BRFSS estimates in order to see how accurate the estimation is and to determine if there are any outliers within the region. Outliers were a potential reason why differences were found in this study. This study only looked at percent prevalence of chronic illnesses; future studies should analyze other variables that are BRFSS-designated variables that are also commonly used in CHAs. Additionally, state outside of Ohio should be studied in order to determine if their BRFFS regionally-estimated health indicators can serve as a sound substitute for health indicators that are calculated through CHAs outside of Ohio.

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APPENDIX I: SURVEYS

Hocking County Health Survey, Relevant Questions

HOCKING COUNTY HEALTH SURVEY

This survey should be completed by the adult aged 18 or over at this address who MOST RECENTLY had a birthday. All responses will remain confidential, so please answer honestly.

YOUR OVERALL HEALTH

These questions ask about your physical and mental health.

1. Would you say that in general your health is... [CIRCLE ONE ANSWER]

Excellent	*Very good*	*Good*	*Fair*	*Poor*

2. During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation? [WRITE A NUMBER] ____

3. During the past 30 days, for about how many days have you felt sad, blue, or depressed?
[WRITE A NUMBER] ____

4. How often do you get the social and emotional support you need? [CIRCLE ONE ANSWER]

Always	*Usually*	*Sometimes*	*Rarely*	*Never*

5. Has a doctor, nurse, or other health professional EVER told you that you had...
[FOR EACH QUESTION, CIRCLE ONE ANSWER]

5a. Asthma?	*Yes*	*No*
5b. Skin cancer?	*Yes*	*No*
5c. Any other types of cancer?	*Yes*	*No*
5d. Diabetes?	*Yes*	*No*
5e. High blood pressure?	*Yes*	*No*
5f. High blood cholesterol?	*Yes*	*No*

Licking County Health Assessment Survey Questionnaire, Relevant Sections

Section 4: Hypertension Awareness

4.1 Have you EVER been told by a doctor, nurse, or other health professional that you have high blood pressure?

(101)

Read only if necessary: By "other health professional" we mean a nurse practitioner, a physician's assistant, or some other licensed health professional.

5.3 Have you EVER been told by a doctor, nurse or other health professional that your blood cholesterol is high?

(105)

1 Yes
2 No
7 Don't know / Not sure
9 Refused

6.4 (Ever told) you had asthma?

(109)

1	Yes	
2	No	**[Go to Q6.6]**
7	Don't know / Not sure	**[Go to Q6.6]**
9	Refused	**[Go to Q6.6]**

6.6 (Ever told) you had skin cancer?

(111)

1	Yes
2	No
7	Don't know / Not sure
9	Refused

6.7 (Ever told) you had any other types of cancer?

(112)

1	Yes
2	No
7	Don't know / Not sure
9	Refused

6.9 (Ever told) you have some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia?

(114)

1 Yes
2 No
7 Don't know / Not sure
9 Refused

6.10 (Ever told) you have a depressive disorder, including depression, major depression, dysthymia, or minor depression?

(115)

1 Yes
2 No
7 Don't know / Not sure
9 Refused

6.12 (Ever told) you have diabetes? (117)

If "Yes" and respondent is female, ask: "Was this only when you were pregnant?"

If respondent says pre-diabetes or borderline diabetes, use response code 4.

1 Yes
2 Yes, but female told only during pregnancy
3 No
4 No, pre-diabetes or borderline diabetes
7 Don't know / Not sure
9 Refused

Section 4: Hypertension Awareness

4.1 Have you EVER been told by a doctor, nurse, or other health professional that you have high blood pressure?
Read only if necessary: By "other health professional" we mean a nurse practitioner, a physician's assistant, or some other licensed health professional.

If "Yes" and respondent is female, ask: "Was this only when you were pregnant?"

1 Yes
2 Yes, but female told only during pregnancy [Go to next section]
3 No [Go to next section]
4 Told borderline high or pre-hypertensive [Go to next section]
7 Don't know / Not sure [Go to next section]
9 Refused [Go to next section]

5.3 Have you EVER been told by a doctor, nurse or other health professional that your blood cholesterol is high?

1 Yes
2 No
7 Don't know / Not sure
9 Refused

Section 6: Chronic Health Conditions

Now I would like to ask you some questions about general health conditions.

Has a doctor, nurse, or other health professional EVER told you that you had any of the following? For each, tell me "Yes," "No," or you're "Not sure."

6.4 (Ever told) you had asthma?

1 Yes
2 No [Go to Q6.6]
7 Don't know / Not sure [Go to Q6.6]
9 Refused [Go to Q6.6]

6.6 (Ever told) you had skin cancer?

1 Yes
2 No
7 Don't know / Not sure

6.7 (Ever told) you had any other types of cancer?

1 Yes
2 No
7 Don't know / Not sure
9 Refused

6.9 (Ever told) you have some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia?

1 Yes
2 No
7 Don't know / Not sure
9 Refused

6.10 (Ever told) you have a depressive disorder (including depression, major depression, dysthymia, or minor depression)?

1 Yes
2 No
7 Don't know / Not sure
9 Refused

6.13 (Ever told) you have diabetes?

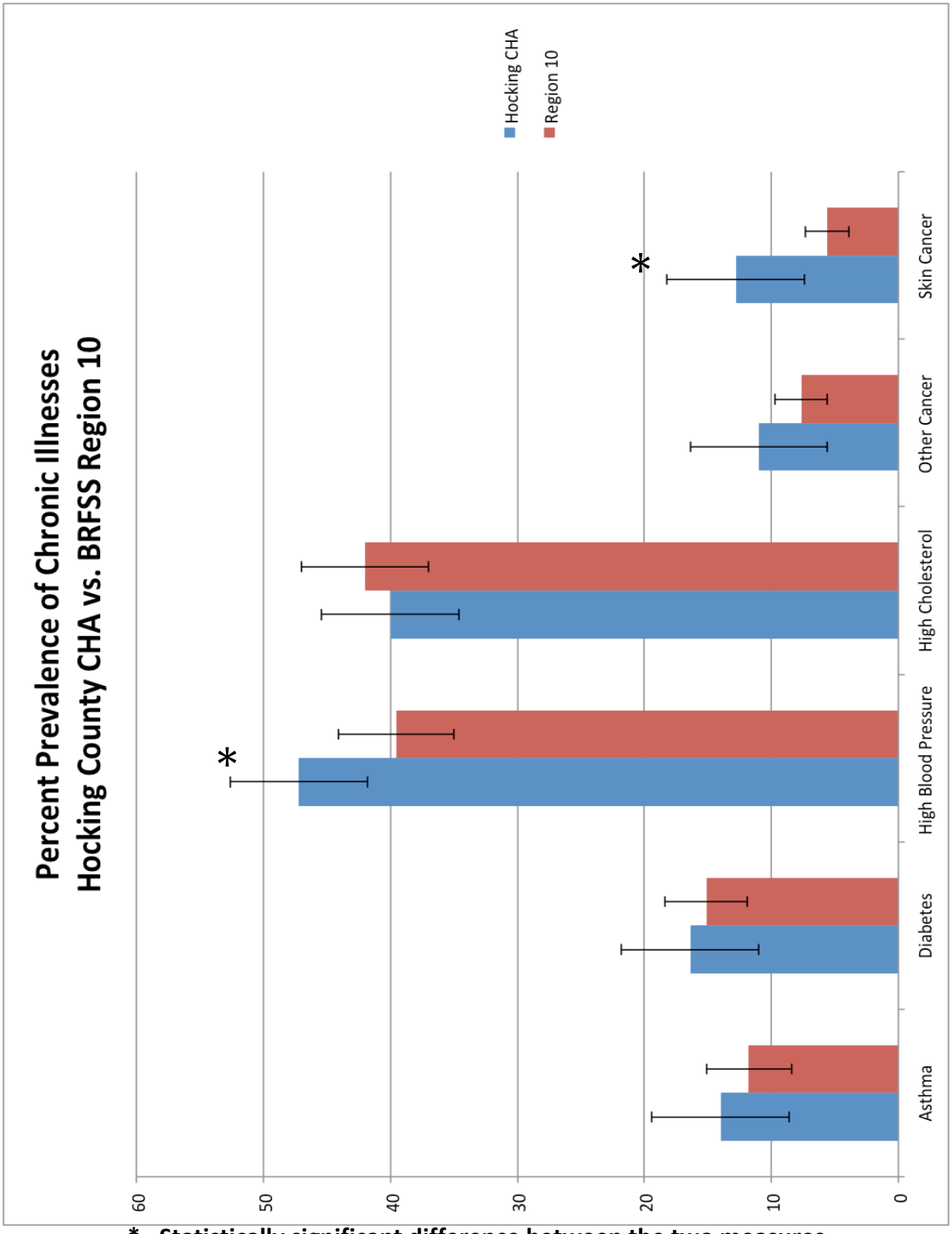
If "Yes" and respondent is female, ask: "Was this only when you were pregnant"?

If respondent says pre-diabetes or borderline diabetes, use response code 4.

1 Yes
2 Yes, but female told only during pregnancy
3 No
4 No, pre-diabetes or borderline diabetes
7 Don't know / Not sure
9 Refused

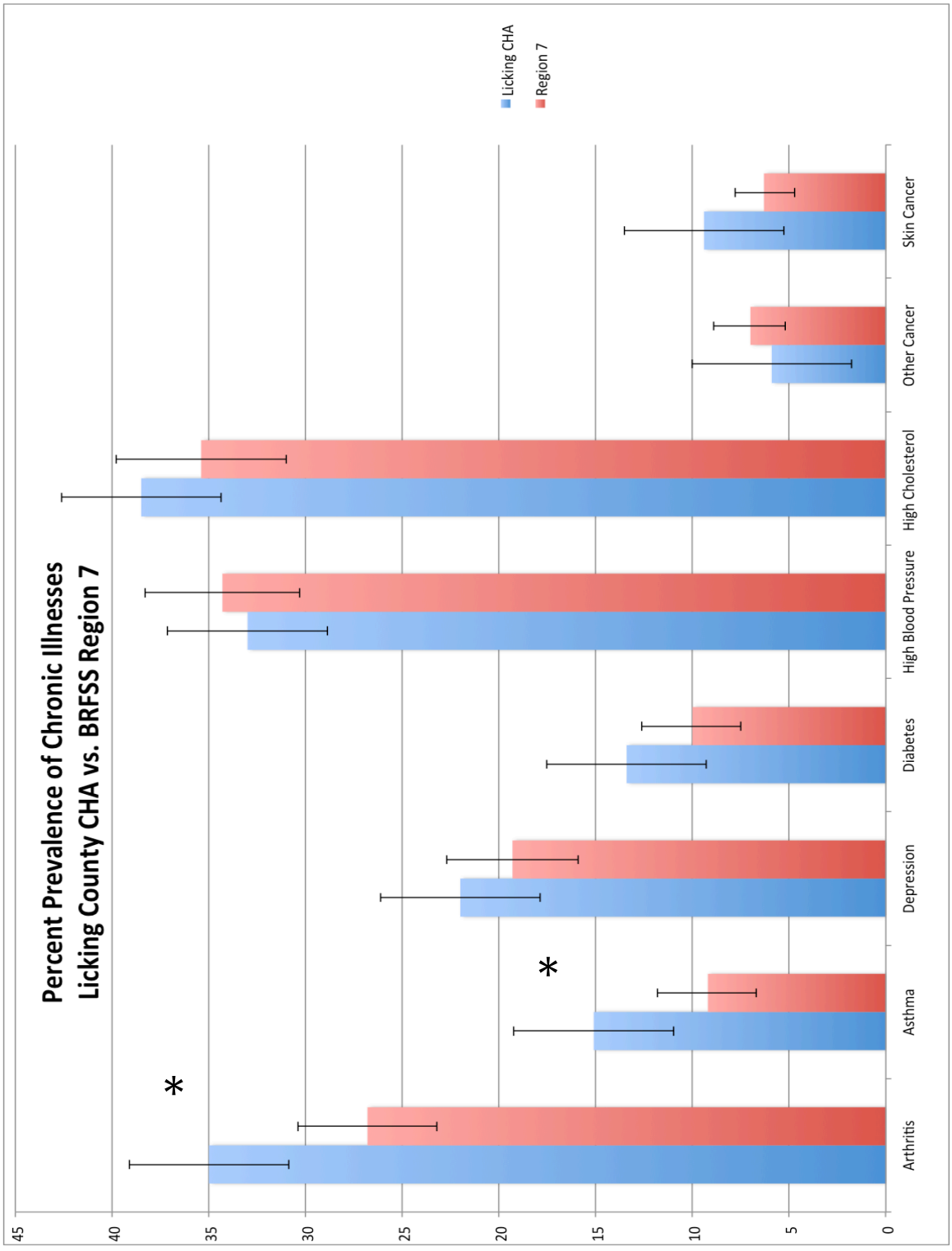
APPENDIX II: FIGURES

Figure 2: Percent Prevalence of Chronic Illness, Hocking County



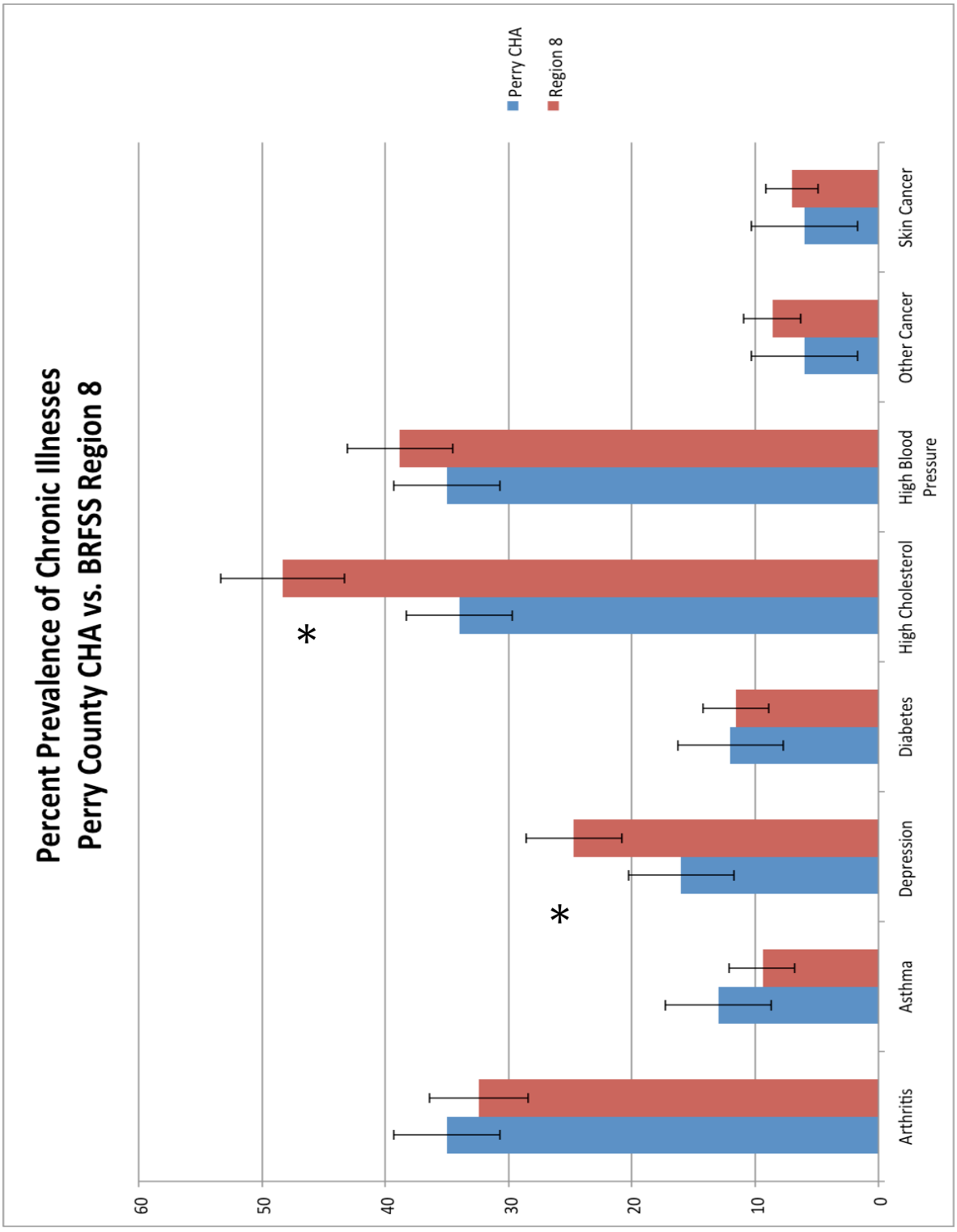
***= Statistically significant difference between the two measures**

Figure 3: Percent Prevalence of Chronic Illness, Licking County



***= Statistically significant difference between the two measures**

Figure 4: Percent Prevalence of Chronic Illness, Perry County



***= Statistically significant difference between the two measures**

APPENDIX III: COMPLETE CALCULATIONS

Hocking County vs. BRFSS Region 10

$$\boldsymbol{Hocking\ CHA\ SE = \frac{MOE}{Z\ 95\%\ Critical\ Value} = \frac{5.4}{1.96} = 2.76}$$

$$\left|\frac{X_1 - X_2}{\sqrt{SE_1^2 + SE_2^2}}\right| > Z_{95\%} = statistical\ significance$$

Asthma

$$\boldsymbol{BRFSS\ SE = \frac{3.35}{1.96} = 1.71 \quad Z\ score = \left|\frac{14 - 11.8}{\sqrt{2.76^2 + 1.71^2}}\right| = 0.68;\ 0.68 < 1.96}$$

Diabetes

$$\boldsymbol{BRFSS\ SE = \frac{3.25}{1.96} = 1.66 \quad Z\ score = \left|\frac{16.4 - 15.1}{\sqrt{2.76^2 + 1.66^2}}\right| = 0.4\ ;0.4 < 1.96}$$

High Blood Pressure

$$\boldsymbol{BRFSS\ SE = \frac{4.55}{1.96} = 2.32 \quad Z\ score = \left|\frac{47.2 - 3.95}{\sqrt{2.76^2 + 2.32^2}}\right| = 2.4\ ;2.4 > 1.96\ *}$$

High Cholesterol

$$\boldsymbol{BRFSS\ SE = \frac{5.0}{1.96} = 2.55 \quad Z\ score = \left|\frac{40.0 - 42.0}{\sqrt{2.76^2 + 2.55^2}}\right| = 0.14\ ;0.14 < 1.96}$$

Other Cancer

$$\boldsymbol{BRFSS\ SE = \frac{2.15}{1.96} = 1.10 \quad Z\ score = \left|\frac{11.0 - 7.6}{\sqrt{2.76^2 + 1.10^2}}\right| = 1.14\ ;1.14 < 1.96}$$

Skin Cancer

$$\boldsymbol{BRFSS\ SE = \frac{1.70}{1.96} = 0.87 \quad Z\ score = \left|\frac{12.8 - 5.6}{\sqrt{2.76^2 + 87}}\right| = 2.49\ ;2.49 > 1.96\ *}$$

Licking County vs. BRFSS Region 7

$$\boldsymbol{Licking\ CHA\ \ SE = \frac{MOE}{Z\ 95\%\ Critical\ Value} = \frac{4.13}{1.96} = 2.11}$$

$$\left|\frac{X_1 - X_2}{\sqrt{SE_1^2 + SE_2^2}}\right| > Z_{95\%} = statistical\ significance$$

Arthritis

$$\boldsymbol{BRFSS\ SE = \frac{3.6}{1.96} = 1.84 \qquad Z\ score = \left|\frac{35 - 26.8}{\sqrt{2.11^2 + 1.84^2}}\right| = 2.93;\ 2.93 > 1.96\ *}$$

Asthma

$$\boldsymbol{BRFSS\ SE = \frac{2.55}{1.96} = 1.30 \qquad Z\ score = \left|\frac{15.1 - 9.2}{\sqrt{2.11^2 + 1.30^2}}\right| = 2.38;\ 2.38 > 1.96\ *}$$

Depression

$$\boldsymbol{BRFSS\ SE = \frac{3.40}{1.96} = 1.73 \qquad Z\ score = \left|\frac{22 - 19.3}{\sqrt{2.11^2 + 1.73^2}}\right| = 0.99;\ 0.99 < 1.96}$$

Diabetes

$$\boldsymbol{BRFSS\ SE = \frac{2.55}{1.96} = 1.30 \qquad Z\ score = \left|\frac{13.4 - 10.0}{\sqrt{2.11^2 + 1.30^2}}\right| = 1.37;\ 1.37 < 1.96}$$

High Blood Pressure

$$\boldsymbol{BRFSS\ SE = \frac{4.0}{1.96} = 2.04 \qquad Z\ score = \left|\frac{33 - 34.3}{\sqrt{2.11^2 + 2.04^2}}\right| = 0.44;\ 0.44 < 1.96}$$

High Cholesterol

$$\boldsymbol{BRFSS\ SE = \frac{4.0}{1.96} = 2.04 \qquad Z\ score = \left|\frac{33 - 34.3}{\sqrt{2.11^2 + 2.04^2}}\right| = 0.44;\ 0.44 < 1.96}$$

Other Cancer

$$\boldsymbol{BRFSS\ SE = \frac{1.85}{1.96} = 0.94 \quad Z\ score = \left|\frac{5.9 - 7.0}{\sqrt{2.11^2 + 0.94^2}}\right| = 0.48;\ 0.48 < 1.96}$$

Skin Cancer

$$\boldsymbol{BRFSS\ SE = \frac{1.55}{1.96} = 0.79 \quad Z\ score = \left|\frac{9.4 - 6.3}{\sqrt{2.11^2 + 0.79^2}}\right| = 1.38;\ 0.48 < 1.96}$$

Perry County vs. BRFSS Region 8

$$\boldsymbol{Perry\ CHA\ \ SE = \frac{MOE}{Z\ 95\%\ Critical\ Value} = \frac{4.30}{1.96} = 2.19}$$

$$\left|\frac{X_1 - X_2}{\sqrt{SE_1^2 + SE_2^2}}\right| > Z_{95\%} = statistical\ significance$$

Arthritis

$$\boldsymbol{BRFSS\ SE = \frac{4.0}{1.96} = 2.04 \quad Z\ score = \left|\frac{35 - 32.4}{\sqrt{2.19^2 + 2.04^2}}\right| = 0.87;\ 0.87 < 1.96}$$

Asthma

$$\boldsymbol{BRFSS\ SE = \frac{2.65}{1.96} = 1.35 \quad Z\ score = \left|\frac{13 - 9.4}{\sqrt{2.19^2 + 1.35^2}}\right| = 1.40;\ 1.40 < 1.96}$$

Depression

$$\boldsymbol{BRFSS\ SE = \frac{3.90}{1.96} = 1.99 \quad Z\ score = \left|\frac{16 - 24.7}{\sqrt{2.19^2 + 1.99^2}}\right| = 1.94;\ 2.94 > 1.96\ *}$$

Diabetes

$$\boldsymbol{BRFSS\ SE = \frac{2.65}{1.96} = 1.35 \quad Z\ score = \left|\frac{12 - 11.6}{\sqrt{2.19^2 + 1.35^2}}\right| = 0.16;\ 0.16 < 1.96}$$

High Cholesterol

$$\boldsymbol{BRFSS\ SE = \frac{5.0}{1.96} = 2.55} \qquad \boldsymbol{Z\ score = \left|\frac{34 - 48.3}{\sqrt{2.19^2 + 2.55^2}}\right| = 4.25;\ 4.25 > 1.96\ *}$$

High Blood Pressure

$$\boldsymbol{BRFSS\ SE = \frac{4.30}{1.96} = 2.19} \qquad \boldsymbol{Z\ score = \left|\frac{35 - 38.8}{\sqrt{2.19^2 + 2.19^2}}\right| = 1.23;\ 1.23 < 1.96}$$

Other Cancer

$$\boldsymbol{BRFSS\ SE = \frac{2.30}{1.96} = 0.34} \qquad \boldsymbol{Z\ score = \left|\frac{6 - 8.6}{\sqrt{2.19^2 + 0.34^2}}\right| = 1.17;\ 1.17 < 1.96}$$

Skin Cancer

$$\boldsymbol{BRFSS\ SE = \frac{2.10}{1.96} = 1.07} \qquad \boldsymbol{Z\ score = \left|\frac{6 - 7}{\sqrt{2.19^2 + 1.07^2}}\right| = 0.41;\ 0.41 < 1.96}$$